Session 2: Science of Mobility in the ICU

Vicki Spuhler, RN, MS
Kelly McCutcheon Adams, LICSW
November 29, 2012

These presenters have nothing to disclose

Expedition Coordinator

Kayla DeVincetis, Project Coordinator, has worked at IHI since 2009, starting as an intern in the Event Planning department. Since then, Kayla has contributed to the STAAR Initiative, the IHI Summer Immersion Program, and the IHI Expeditions. Kayla obtained her Bachelor’s in Health Science from Northeastern University and brings her interest in health and wellness to IHI’s Health and Fitness team.
WebEx Quick Reference

• Welcome to today's session!
• Please use Chat to “All Participants” for questions
• For technology issues only, please Chat to “Host”
• WebEx Technical Support: 866-569-3239
• Dial-in Info: Communicate / Join Teleconference (in menu)

When Chatting…

Please send your message to All Participants
Expedition Director

Kelly McCutcheon Adams has been a Director at the Institute for Healthcare Improvement since 2004. Her primary areas of work with IHI have been in Critical Care and End of Life Care. She is an experienced medical social worker with experience in emergency department, ICU, nursing home, sub-acute rehabilitation, and hospice settings. Ms. McCutcheon Adams served on the faculty of the U.S. Department of Health and Human Services Organ Donation and Transplantation Collaboratives and serves on the faculty of the Gift of Life Institute in Philadelphia. She has a B.A. in Political Science from Wellesley College and an MSW from Boston College.

Expedition Faculty

Vicki J. Spuhler, RN, MS, has recently retired as a Nurse Manager, Intermountain Healthcare, Intermountain Medical Center, where she specialized in trauma and respiratory critical care. She is on the nursing faculty at the University of Utah. She has been a faculty member for IHI since 1994 and participated in the Adult Critical Care Breakthrough Series Collaborative, as well as the IMPACT network’s ICU innovation work. She is an active member of the Society for Critical Care Medicine and is a past chair of their patient/family support committee. Ms. Spuhler has received awards from Intermountain Health Care, the American Association of Critical Care Nurses, and the Honor Society for Nursing, Sigma Theta Tau, for her accomplishments in management and clinical process improvement.
Today’s Agenda

- Review of homework: Kelly
- Science of Mobility in the ICU: Vicki
- Homework for next session: Kelly & Vicki

Expedition Objectives

At the conclusion of the Expedition, participants will be able to:

- Describe the impact of immobility on the long term outcomes of critically ill patients.
- Define the elements necessary for the development of a mobility protocol.
- Create process measures and outcome measures for a successful early mobility program.
- Identify strategies for overcoming cultural barriers to early mobility.
Schedule of Calls

Session 2: Science of Mobility in the ICU
Date: Thursday, Nov 29, 3:00-4:00 PM ET
(please note that the topics for sessions 3 and 4 have swapped dates – what is listed below is accurate)

Session 3: Protocol Development
Date: Thursday, Dec 20, 3:00-4:00 PM ET

Session 4: The Role of Physical Therapy
Date: Thursday, Jan 10, 3:00-4:00 PM ET

Session 5: Case Examples of Improved Mobility in the ICU
Date: Thursday, Jan 24, 3:00-4:00 PM ET

Review of Homework from Last Call

• Complete the Mobility Data Collection Tool on three days for ten patients each time.

<table>
<thead>
<tr>
<th>Pt.</th>
<th>FIO2</th>
<th>peep</th>
<th>LOC</th>
<th>Receiving Sedation</th>
<th>Medication name</th>
<th>drip</th>
<th>bolus</th>
<th>Rate/amount</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAMPLE</td>
<td>.50</td>
<td>5</td>
<td>RASS-2</td>
<td>Y</td>
<td>N</td>
<td>Propofol 15mcg/kg/min</td>
<td>yes</td>
<td>No</td>
<td>90mg/hr</td>
</tr>
<tr>
<td>1</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Review of User Group Responses

**Have you tried any stages of mobilization at your organization? What were the results?**

*Rhonda Collins:* We initiated an early mobility program a few weeks ago, but are still struggling with logistics and with team "buy-in".

*Shawna Strouth-Shaw:* We started an early mobility program approximately 2 years ago. This effort has been challenging for multiple reasons in our ICU. At the top of the list is the cultural change that comes with early mobility.

*Robert Amoruso:* We do this haphazardly. Mobility used to be a standard, but it has gone by the wayside. We are again trying to standardize early mobility of all ICU patients, such as we have done for VAPs/BSIs, sepsis, DVT, etc.

*Arlene Bourdeaux:* We do work hard at early mobility but have a specialty population that can be challenging. We are a Neuro ICU and have few vented patients. Those with vents usually are not cognitively aware enough to walk. Our challenge is mobilizing patients with hemiparesis or hemiplegia.
What are the Questions?

- What is the effect of immobilization on functional outcomes of patients who spent time in the ICU?
- What is the long term effect of immobilization beyond discharge?
- Is early activity safe?
- Can early mobility be done in the ICU?

One-year Outcomes in Survivors of the Acute Respiratory Distress Syndrome

“Survivors of the acute respiratory distress syndrome have persistent functional disability one year after discharge from the ICU. Most patients have extra pulmonary conditions, with muscle wasting and weakness being most prominent.”

Study Data

- 109 survivors of ARDS.
- Measured HRQL, six-minute walk, and pulmonary function at 3, 6 and 12 months post discharge.
- Median data
  - 47 years of age (36-58)
  - APACHE II: 23 (17-27)
  - Vent days 21 (12-40)
  - ICU LOS 25 days (15-45)

Results

- Patients had lost 18% of their base-line body weight at discharge from the ICU.
- Muscle wasting and fatigue were primary factors in functional limitations.
- Lung volume and spirometric measurements were normal by 6 months post discharge.
- No patient required supplemental oxygen at 12 months.
Results

Only 49% were working at 12 months.
- Persistent weakness and fatigue
- Poor functional status as result of foot drop and immobility of large joints

Why?

- Use of corticosteroids—main determinant at 3 months- lost by 6 months
- Complications of critical illness acquired during the ICU stay.
- Rate of illness resolution.
Why?

Changes in the nerves, muscles and neuromuscular junction:
- Polyneuropathy of critical illness.
- Atrophy or disuse myopathy resulting from prolonged use of sedation and paralytic agents.

Poor Functional Outcomes Immediately after Discharge from ICU

- Nearly all patients that were mechanically ventilated for at least 6 days were severely or totally dependent in their ADLs.
- Multivariate analysis showed that reduced upper-extremity strength and walking difficulties were the most important independent factors of poorer functional status.
  - Age and severity of illness at ICU admission were not found to be associated with short-term functional status.
  - The cardiac and respiratory functioning of these critically ill patients was stable.

Van der Schaff et al. Disability and Rehab 2008; 30(23): 1812-1818
Functional limitations

- Garland et al: Chest 2004:
  - 1722 patients from 5 medical centers: patients who had spent 10 days in the ICU had substantial impairment in functional and quality of life outcomes.

- Toronto Critical Care Trials: Herridge NEJM 2003
  - 83 ARDS survivors between 1998-2006 followed for 5 years. Median age 45.
  - At 5 years, patients continued to complain of weakness and functional limitation and were only able to walk 76% predicted distance in 6 minutes.

- Netherlands study- Group: Journal Rehab Med. 2009
  - 54% of survivors of critical illness had significant restrictions in daily functioning.

Caregiver Burden of Illness


- **Two months after being placed on MV for at least 48 h, a high proportion of patients need caregiver support.** Approx 34% of caregivers are at risk of clinical depression, 31% of caregivers had to stop working or reduced the amount of work due to caring for the pts. More than half of the caregivers reported spending 4 h/d to help pts with ADL and activities. In addition, 69% of the caregivers said that they received help from paid caregivers.
Caregiver Burden of Illness

  - Found a high prevalence of depression risk, and that reduction in employment and lifestyle disruptions were common and persistent. First to suggest that this burden may be a direct consequence of critical illness.

  - Informal caregivers experience negative health outcomes that persist almost 2 yrs after ARDS. Caregivers reported poor HRQL across all domains of SF-36 compared with age- and gender-matched population values. Significant lifestyle disruption similar to caregivers of Alzheimer's patients.
Caregiver Burden of Illness


  - 51% of caregivers at discharge and 36.4% at 6 months after discharge reported symptoms consistent with some degree of depression. Caregiver physical health and overload made statically significant contributions to explaining caregiver depression. Caregivers had slightly worse ratings of physical health than other groups of caregivers (Alzheimer).

Is early activity feasible and safe?
Early Activity is Feasible and Safe in Respiratory Failure Patients


N = 103

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>APACHE II</td>
<td>26 ± 4.9</td>
<td>26</td>
</tr>
<tr>
<td>MOF*</td>
<td>4.5 ± 2.8</td>
<td>4</td>
</tr>
<tr>
<td>Lowest P/F ratio</td>
<td>97.8 ± 46.8</td>
<td>89</td>
</tr>
<tr>
<td>Total ICU LOS</td>
<td>22.7 ± 15.9</td>
<td>18</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>26.6 ± 17</td>
<td>22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Co-morbidities</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>1</td>
<td>26</td>
</tr>
<tr>
<td>2</td>
<td>57</td>
</tr>
</tbody>
</table>

Early Activity is Feasible and Safe in Respiratory Failure Patients

Crit Care Med 2007; 35:139-145

Table 3. Activity level in survivors on the last full day of respiratory intensive care unit admission

<table>
<thead>
<tr>
<th>Activity</th>
<th>Total Group (n = 85)</th>
<th>Age &lt;65 yrs (n = 49)</th>
<th>Age ≥65 yrs (n = 36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No activity</td>
<td>2 (2.4)</td>
<td>0</td>
<td>2 (5.6)</td>
</tr>
<tr>
<td>Sit on bed</td>
<td>4 (4.7)</td>
<td>2 (4.1)</td>
<td>2 (5.6)</td>
</tr>
<tr>
<td>Sit in chair</td>
<td>13 (15.3)</td>
<td>5 (10.2)</td>
<td>8 (22.2)</td>
</tr>
<tr>
<td>Ambulate ≤100 feet</td>
<td>7 (8.2)</td>
<td>6 (12.2)</td>
<td>1 (2.8)</td>
</tr>
<tr>
<td>Ambulate &gt;100 feet</td>
<td>59 (69.4)</td>
<td>36 (73.5)</td>
<td>23 (63.8)</td>
</tr>
</tbody>
</table>

Data are subdivided by age <65 years and age ≥65 years. Values are n (%).
### Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control</th>
<th>Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>APACHE II</td>
<td>19.0</td>
<td>20.0</td>
</tr>
<tr>
<td>Time from intubation with first PT/OT session (days)</td>
<td>7.4</td>
<td>1.5</td>
</tr>
<tr>
<td>Time from intubation to milestones achieved (days)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Out of bed</td>
<td>6.6 (4.2-8.3)</td>
<td>1.7 (1-3)</td>
</tr>
<tr>
<td>Standing</td>
<td>6.0 (4.5-8.9)</td>
<td>3.2 (1.5-5.6)</td>
</tr>
<tr>
<td>Walking</td>
<td>7.3 (4.9-9.6)</td>
<td>3.8 (1.9-5.8)</td>
</tr>
</tbody>
</table>

### Early Physical and Occupational Therapy in Mechanically Ventilated, Critically Ill Patients: A Randomized Controlled Trial

Schweickert et al. Lancet 2009 vol 373 no 9678, pp. 1874-1882

<table>
<thead>
<tr>
<th>Results</th>
<th>Treatment</th>
<th>Control</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent functioning at discharge</td>
<td>59%</td>
<td>35%</td>
<td>0.02</td>
</tr>
<tr>
<td>Ambulation (feet)</td>
<td>110</td>
<td>0</td>
<td>0.004</td>
</tr>
<tr>
<td>Ventilator free days</td>
<td>23.5</td>
<td>21.1</td>
<td>0.05</td>
</tr>
<tr>
<td>ICU delirium days</td>
<td>2</td>
<td>4</td>
<td>0.03</td>
</tr>
<tr>
<td>ICU LOS</td>
<td>5.9</td>
<td>7.9</td>
<td>0.08</td>
</tr>
<tr>
<td>Hospital LOS</td>
<td>13.5</td>
<td>12.9</td>
<td>0.93</td>
</tr>
<tr>
<td>ICU acquired paresis at discharge</td>
<td>15 (31%)</td>
<td>27 (49%)</td>
<td>0.09</td>
</tr>
<tr>
<td>Mortality</td>
<td>9 (18%)</td>
<td>14 (25%)</td>
<td>0.53</td>
</tr>
</tbody>
</table>
Is it Safe?
Early Activity is Feasible and Safe in Respiratory Failure Patients


Adverse events occurred in 14 of 1,449 (0.96%, 10^{-2}) activity events:

• **Five** falls to the knees without injury.
• **Four** systolic blood pressure < 90.
• **Three** oxygen desaturations < 80%.
• **One** nasal, small bowel feeding tube removal.
• **One** systolic blood pressure > 200.

Is it Safe?
Early Activity is Feasible and Safe in Respiratory Failure Patients

• Adverse events that did not occur in any patient as a result of activity:
  — Unplanned extubation.
  — Longer LOS/Additional cost.
  — Other complication that required additional therapy.
There were no adverse events.

- 1.4% of passive and active sessions were not initiated because of either a high or low blood pressure.
- 0.9% of sessions were not initiated because of either too high or too low a heart rate.
- Most frequent reason for ending a mobility session was patient fatigue occurring without a significant change in the patient’s vital signs.
- No accidental removal of a device.

Is it Safe?

Early Intensive Care Unit Mobility Therapy in the Treatment of Acute Respiratory Failure

Adverse events occurred in 1 of 498 physical and occupational therapy sessions:

- Zero falls to the knees.
- Zero systolic blood pressure < 90.
- One oxygen desaturations < 80%.
- Zero systolic blood pressure > 200.
- No unplanned extubations.
Meta Rules

1. It is difficult to recondition a patient that is obtunded due to over sedation or use of narcotics.
   - minimize sedative and narcotic use by incorporating agents with minimal CNS and respiratory depression.
2. It is difficult to recondition a patient that has excessive breathlessness or becomes hypoxic during activity.
   - Support work of breathing during and prevent desaturation during physical activity.

Meta Rules

3. Patients should not refuse activity any more than they could refuse an antibiotics or other important intervention.
4. Activity should be progressed aggressively.
5. Activity may be suspended for 24 hours if the patient has an acute unstable event.
6. When patients appear not to have the strength to do both reconditioning and weaning, support their reconditioning first, then the weaning. Physical strengthening will help to overcome weaning difficulties.
Begin Activity

1. Patient responds to verbal stimuli with eye opening. Do not wait for them to become alert, follow commands, or be interactive. Often patients who appear unable to participate will tolerate activity and improve neuro status.

2. FIO2 is less than or equal to .60 and PEEP is less than or equal to 10. Mobility can often be initiated successfully at higher levels of FIO2 and PEEP with minimal desaturation events.

Begin Activity

3. Agitation and delirium are not exclusion for activity and will often improve once conditioning improves.
First step is to dangle

To Chair
The Dance
Prevent desaturation during activity:

1. Increase patients FIO2 by .20 before beginning activity if desaturation is anticipated.
2. Monitor oxygen saturation during and after activity.
3. If patient:
   - is on pressure support/CPAP place them on A/C during activity.
   - can ambulate and is intubated – ventilate with a 100% bag during activity.
   - can ambulate and is post extubation they should be monitored with oximetry to keep SaO2>90%.

4. If patient has excessive dyspnea
   - Avoid suspending activity due to breathlessness and dyspnea by allowing the patient to pause and rest at short intervals.
   - For extremely deconditioned patients on MV try giving a short rest on A/C about 30 minutes prior to and 30 minutes after their exercise.
Progress activity as follows

1. Dangle patients with assistance. Sit patient on the bed with legs over the edge and touching the floor (if possible). Support the torso until the patient can sit independently.

2. Stand patient at bedside with support. Begin weight bearing on one or two legs.

3. Transfer to chair by pivot or taking one or two small steps.

4. Walk with assistance. May use a walker or physical support of an individual (PT). Always have a wheelchair following behind incase the patient becomes exhausted and/or breathless and needs to suspend activity.

5. Walk Independently 200 feet before discharge.
Supportive guidelines

- Decision support
  - choose decision points for tapering sedation/narcotics that are objective. While sedation scoring is helpful, it is also vulnerable to clinician bias.
  - Objective measures allows care to stop and change directions.

Example:

- When FiO2 ≥ 0.7, daily sedation vacation if on continuous sedation infusion.
- When FiO2 ≤ 0.6, DC continuous infusions and choose alternative medications and route. Ativan is a last resort. Promote sleep and wean narcotics.
- When FiO2 ≤ 0.5, patients are weaned off of benzodiazepines and narcotics as possible.
Questions?

Raise your hand

Use the Chat

Homework for Next Call

- Complete the Mobility Data Collection Tool #2 (will be sent via listserv) on at least 2 patients per day for 5 days before the next call. Start with patients who are on 50% <10 peep.
- Respond to the discussion question on the user group by Tuesday, December 18th at 5:00 PM ET.

<table>
<thead>
<tr>
<th>PK</th>
<th>ID</th>
<th>Code</th>
<th>DC</th>
<th>Indication</th>
<th>Medications started</th>
<th>Type of activity</th>
<th>Stair</th>
<th>Distance</th>
<th>Level code</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Y</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Expedition Communications

- Listserv for session communications: MobilityExpedition@ls.ihi.org
- To add colleagues, email us at improvementmap@ihi.org
- Pose questions, share resources, discuss barriers or successes

Next Session

Session 3: Protocol Development
Date: Thursday, Dec 20, 3:00-4:00 PM ET*

* Please note that this is more than two weeks from now due to the IHI Forum taking place in Orlando, FL from Dec 9-12.